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**Item 3 of the provisional agenda**

**Strengthening participation of developing countries in dynamic and new sectors of  
world trade: Trends, issues and policies in the electronics sector\***

Background note by the UNCTAD secretariat

**Executive summary**

The first sectoral review meeting on dynamic and new sectors of world trade, conducted by an Expert Meeting during 5–7 February 2005, highlighted the crucial role of the electronics sector in enabling a number of developing countries to improve trade performance over the past two decades. East and Southeast Asian countries lead the share of developing countries in world trade in electronics, followed by the Latin American and Caribbean region. North African and Middle Eastern countries have picked up the trend, but sub-Saharan African countries are still lagging behind. The developing countries as a whole appear to have become a major player in the expanding global production networks in electronics, dominated by large transnational corporations with developed countries as their home base. These networks have brought about fundamental changes in the organization of production by farming out production of standardized goods to geographically dispersed locations.

It appears that, given the rapid pace of changes in technology, organization of production, management practices and information flows within the electronics sector, coupled with intense price competition and changing demand and preference patterns fuelled by product differentiation, it will be more difficult for late or new entrants to establish a significant export presence. Yet the inexorable pressure on global production networks to constantly look for the lowest-cost sources of supply will keep the door open for latecomers. However, a major lesson from successful experiences is that countries themselves need to make the necessary strategic policy choices based on a realistic assessment of the actual and potential comparative advantages with regard to different subsectors as well as in the context of the entire value chain. Furthermore, success depends on effectiveness in identifying and securing opportunities within particular product groups and production networks. Nevertheless, the following set of factors are worth noting: (a) robust and flexible supply capacity to respond to rapidly changing demand and preference conditions; (b) effectiveness of integration into international production networks; (c) avoiding the low- and declining-value-added trap; (d) adequate market access and market entry conditions; and (e) South-South regional cooperation to enhance the supportive environment for latecomers and newcomers to this sector.

\* This document is being issued on the above date for technical reasons.

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## Introduction

1. The first sectoral review meeting on dynamic and new sectors of world trade, conducted by an Expert Meeting during 5-7 February 2005, elucidated how export diversification, including into dynamic and new export product groups, had contributed to developing countries' overall trade performance over the past two decades.<sup>1</sup> The contribution of the electronics sector has been key to these successes in a number of developing countries, especially in Asia. In value terms, manufactures, including electronics in particular, now account for eight of the top 10 export items from developing countries, the other two items being crude oil and petroleum products.

2. Electronic product groups dominate the dynamic sectors of world trade. The annex to this report ranks the top 40 most dynamic product groups in world trade from 1985 to 2002 in terms of increases in their share of world trade. The importance of the electronics sector is clear, as these lists are dominated mainly by three product categories: electronic and electrical goods (SITC 75, 76, 77), chemicals (SITC 5) and miscellaneous manufactures (SITC 8). The electronic and electrical goods products included in this table accounted for 15 per cent of total world goods exports in 2002.

### I. Trends in world trade in electronics

3. As table 1 indicates, world exports of electronic and electrical products experienced sustained expansion. Particularly noteworthy is the high export value growth of the following product groups: computer equipment, office equipment, telecommunication equipment, electric circuit equipment, and valves and transistors. Between 1990 and 2003, developing countries recorded rapid and sustained increases in almost all of the product groups in the table. In as many as six product groups, these countries now account for one half or more of world exports. In some categories, their share in world exports has increased several-fold from a relatively low base.

4. After years of expansion, global electronics exports appear to have slowed in 2004. However, available estimates indicate that not all countries have been affected by this downturn in the same way. Significantly, developing countries appear to have coped with it better than most of the established developed-country players. Despite the slowdown, the overall outlook for the sector remains positive, with rapid advances in technology likely to reinforce demand.

5. Developed countries' performance in the electronics sector has been dominated by one main feature: the decline in supremacy of the United States and Japan, which, however, remain the most dominant host countries of the global production networks in this sector. On the one hand, other developed countries such as the United Kingdom, Germany, Sweden, Canada and the Netherlands have been steadily moving up the ranks in some specific products; on the other hand, Japan and the United States have seen an erosion in the value of their top exports. This trend can be explained by the rise in competition for electronics, paradoxically accelerated by the rational behaviour of global production networks as they farm out production to diverse geographical locations to take advantage of lower costs and, hence, higher margins and profits.

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<sup>1</sup> Products in dynamic sectors of world trade are those that display high annual growth in export value and/or register substantial increases in their share of world trade, while products in new sectors of world trade are intrinsically new or simply new as traded goods.

**Table 1. Trends in world exports of electronic and electrical products and the share of developing countries**

Product groups		Exports to world (\$ millions)				Share of developing countries in world exports (%)			
SITC Code	Description	1990	1995	2000	2003	1990	1995	2000	2003
1	2	3	4	5	6	7	8	9	10
741	Indust heat/cool equipment	22 844	38 085	48 592	60 398	5.67	17.70	17.87	20.87
751	Office machines	10 753	15 946	15 662	13 191	10.29	28.68	31.13	36.43
752	Computer equipment	68 510	131 829	211 896	222 419	20.01	32.80	39.93	49.72
759	Office equip parts/accs.	47 736	98 887	177 418	172 992	14.54	34.76	45.34	49.94
761	Television receivers	15 515	23 847	29 829	38 673	34.09	60.60	50.99	53.50
762	Radio broadcast receiver	9 682	22 453	19 610	16 894	50.96	70.77	68.90	62.84
763	Sound/TV recorders etc	15 290	21 389	27 906	43 155	23.63	54.11	43.88	53.71
764	Telecomms equipment nes	54 792	121 028	257 433	259 162	16.75	31.43	28.03	39.63
771	Elect power transm equip	9 858	23 409	41 034	39 964	19.09	42.00	43.20	42.36
772	Electric circuit equipmt	34 640	66 030	108 206	118 385	8.53	22.83	28.75	29.43
773	Electrical distrib equip	13 080	29 502	46 823	48 342	14.70	31.42	34.58	33.78
774	Medical etc el diag equi	7 730	12 389	18 483	26 429	0.83	3.17	5.37	5.29
775	Domestic equipment	18 530	31 462	40 821	55 138	12.52	29.12	33.99	36.78
776	Valves/transistors/etc	60 391	188 763	333 326	314 009	28.74	40.25	44.37	50.44
778	Electrical equipment nes	35 987	79 827	113 990	120 186	10.18	27.50	26.43	32.14

Note: Based on SITC Rev. 3.

Source: Estimates based on WITS/COMTRADE data.

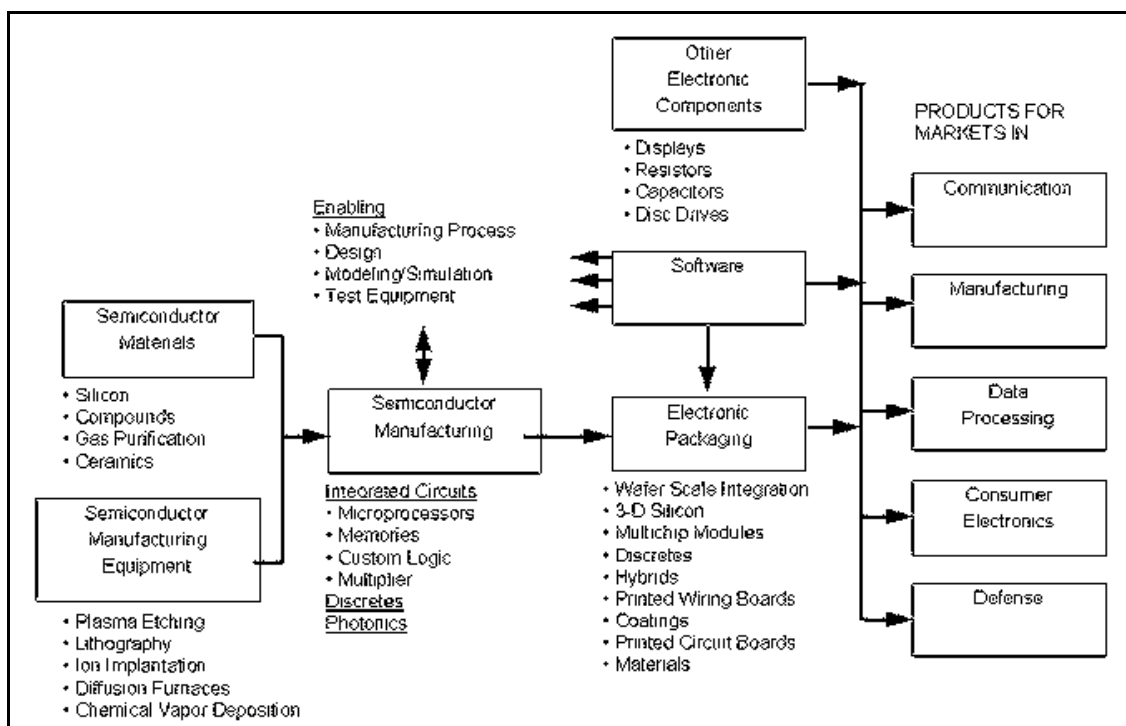
6. The ability of some East Asian countries to successfully compete with developed countries in this sector is a development that very few sectors can boast. For example, in the past 20 years, the preponderance of manufacturing and assembly of some electronic products such as semiconductors and components has shifted from the United States and the United Kingdom to Japan and, over the past 10 years, to the Republic of Korea, Taiwan Province of China, Malaysia and Singapore. In fact, as early as 1994, Taiwan Province of China supplanted the United Kingdom as the fifth largest integrated circuits manufacturer in the world, and Malaysia has become the largest exporter of electronic products. Now, a number of other developing countries with the appropriate mix of skilled and low-cost workers, such as China, India and Thailand, are vying for opportunities to become new manufacturing bases, while the Republic of Korea, Singapore and Taiwan Province of China have continued to upgrade technology and production.

7. The global production networks, dominated by major transnational corporations (TNCs) with developed countries as their home base, have been a determining factor in transforming the

electronics industry into perhaps the most globalized industry over the last three decades or so. These networks have brought about fundamental changes in the organization of production by farming out production of standardized goods like electronic products to geographically dispersed locations through international subcontracting to small and medium-sized enterprises.

8. These networks not only involve vertical integration of production but also extend to other upstream and downstream stages of the value chain, including semiconductor materials and manufacturing equipment, software development, R&D, supply chain management and new product design and development (figure 1). Also, improvements in management practices and increasing use of digital information systems are fast leading to enhanced information exchange in these diverse and often interdependent networks and the sharing and joint creation of knowledge.<sup>2</sup>

**Figure 1. Global electronics production chains and various upstream and downstream linkages**



9. East and Southeast Asian countries have been playing an increasing role in these networks, including with regard to parts and components of electronic products. The electronics sectors in these countries constitutes the single most important area for investment by Japanese and US TNCs. Electronic parts and components trade involving these countries has grown strongly in recent years, indicating the importance to these countries of international production sharing.<sup>3</sup> This also largely explains their increasing share in global electronics exports. Nevertheless, one

<sup>2</sup> Ernst, Dieter (2004). "Searching for a New Role in East Asian Regionalization: Japanese Production Networks in the Electronics Industry." *East-West Center Working Papers*, Economics Series, no. 68.

<sup>3</sup> UNCTAD (2002). *Trade and Development Report 2002*.

should not underestimate the resourcefulness of developed countries in terms of organization of production and accumulated R&D and management capabilities, as reflected by the fact that 85 per cent of global R&D is concentrated in industrial countries and 37 per cent in the United States alone.<sup>4</sup>

## **II. Recent performance of developing countries and economies in transition in world electronics trade**

10. Table 2 shows trends in regional electronics trade and the export performance of various regions.

### **Asia-Pacific countries**

11. Disaggregated data on export value point to the rapid rise of China (about \$60 billion in computer equipment alone in 2004 compared to \$97 million in 1990) as an exporter of electronics, while Taiwan Province of China, the Republic of Korea, Malaysia and Singapore have all continued to consolidate their place as regional leaders in their respective products. In general, these countries initially experienced rapid export growth in this sector, subsequently settling into slower but more sustainable growth as export values expanded. Alongside these high-performing countries, some relatively late entrants such as India and Pakistan have been rapidly expanding their exports since the 1990s. Viet Nam, the Philippines, Bangladesh and Cambodia also show high export growth rates that may well determine future increases in values, depending on these countries' ability to withstand competition from more established competitors in the region.

12. To be sure, the Asian countries have not followed a uniform strategy.<sup>5</sup> The Republic of Korea, following Japan's example, encouraged the development of large company-oriented technology capabilities. In addition, TNCs in the mid-1960s created opportunities for firms in the Republic of Korea to compete in the area of higher-value-added products by absorbing technology from TNCs (e.g. in the field of dynamic random access memories (DRAMs)). The country's current upgrading strategy stresses production of own-brand-name high-precision consumer products and components.

13. In contrast, Taiwan Province of China adopted the strategy of creating public-sector R&D capacities in strategic areas (e.g. integrated circuitry), thereby avoiding unnecessary competition with Japan and the Republic of Korea. The upgrading strategy involves supplying established global brand leaders. To improve efficiency and process specialization, Taiwan Province of China established five research organizations (e.g. the Electronics Research and Service Organization) and accelerated diffusion of technology to thousands of small firms.

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<sup>4</sup> Ernst, Dieter (2004). "Late Innovation Strategies in Asian Electronics Industries: A Conceptual Framework and Illustrative Evidence." *East-West Center Working Papers*, Economics Series, no. 66.

<sup>5</sup> UNCTAD (2002). *Trade and Development Report 2002*. Pp. 103–105. See also Best, M. H., and R. Rasiah (2003). "Malaysian Electronics: At the Crossroads." UNIDO *Technical Working Paper Series*, no. 12.

**Table 2. Trends in regional trade in electronics between 1990 and 2003, selected years**

Product		Exports to world (\$ millions)				Share of Latin American in world exports (%)				Share of Asia Pacific in world exports (%)				Share of North Africa–Middle East in world exports (%)				Share of sub- Saharan Africa in world exports (%)			
		1990	1995	2000	2003	1990	1995	2000	2003	1990	1995	2000	2003	1990	1995	2000	2003	1990	1995	2000	2003
SITC code	Description	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
741	Indust heat/cool equipmt	22 844	38 085	48 592	60 398	1.06	2.32	3.26	3.13	4.12	14.44	13.56	16.71	0.09	0.61	0.65	0.64	0.13	0.16	0.22	0.20
751	Office machines	10 753	15 946	15 662	13 191	1.27	2.83	2.03	1.03	8.82	25.73	28.98	35.20	0.04	0.04	0.06	0.09	0.05	0.04	0.04	0.08
752	Computer equipment	68 510	131 829	211 896	222 419	0.59	1.45	4.02	4.63	19.36	31.31	35.83	44.99	0.03	0.01	0.03	0.02	0.03	0.02	0.03	0.03
759	Office equip parts/accs.	47 736	98 887	177 418	172 992	0.41	0.93	2.89	2.69	14.11	33.70	42.35	47.16	0.01	0.02	0.02	0.03	0.07	0.05	0.05	0.04
761	Television receivers	15 515	23 847	29 829	38 673	0.22	12.71	19.78	16.93	32.14	46.62	27.93	31.57	1.35	0.94	2.84	4.77	0.02	0.03	0.18	0.09
762	Radio broadcast receiver	9 682	22 453	19 610	16 894	3.31	6.30	8.72	9.62	47.26	64.37	59.98	52.88	0.28	0.02	0.06	0.03	0.03	0.03	0.13	0.31
763	Sound/TV recorders etc	15 290	21 389	27 906	43 155	0.02	2.49	2.60	0.73	23.47	51.52	41.20	52.91	0.05	0.03	0.04	0.03	0.02	0.04	0.04	0.02
764	Telecomms equipment nes	54 792	121 028	257 433	259 162	0.27	2.56	4.92	3.52	16.22	28.58	22.87	35.79	0.07	0.08	0.09	0.11	0.10	0.08	0.08	0.10
771	Elect power transm equip	9 858	23 409	41 034	39 964	0.79	4.66	7.02	5.21	17.09	36.26	35.25	35.85	0.53	0.61	0.50	0.75	0.11	0.10	0.15	0.10
772	Electric circuit equipmt	34 640	66 030	108 206	118 385	0.41	3.65	5.13	4.71	7.37	18.41	22.92	23.71	0.23	0.26	0.36	0.61	0.11	0.15	0.06	0.08
773	Electrical distrib equip	13 080	29 502	46 823	48 342	2.13	12.36	15.42	13.35	9.07	16.22	16.31	17.14	1.44	2.36	2.29	2.72	0.20	0.19	0.24	0.23
774	Medical etc el diag equi	7 730	12 389	18 483	26 429	0.06	0.42	1.38	1.01	0.71	2.65	3.80	4.14	0.01	0.02	0.05	0.03	0.04	0.06	0.10	0.05
775	Domestic equipment	18 530	31 462	40 821	55 138	0.99	3.22	4.94	3.82	9.23	23.54	26.51	29.22	0.32	0.90	1.10	2.12	0.10	0.08	0.15	0.09
776	Valves/transistors/etc	60 391	188 763	333 326	314 009	0.21	0.65	1.01	0.79	27.74	39.04	42.74	49.02	0.00	0.00	0.15	0.20	0.01	0.01	0.01	0.02
778	Electrical equipment nes	35 987	79 827	113 990	120 186	1.05	4.66	6.33	5.79	8.39	22.21	19.56	25.51	0.13	0.17	0.18	0.29	0.16	0.12	0.11	0.13

Source: Estimates based on WITS/COMTRADE data.

14. The production of high-end intermediate electronic components, compared with that of end products, is characterized by capability, technology and automation-intensive processes. Singapore and Hong Kong (China) are examples of using TNCs to develop indigenous production, organization and technology management capabilities. Both have enjoyed access to abundant low-cost labour from neighboring countries. Furthermore, Singapore's educational system, which has been constantly restructured since the 1960s, has enabled local operating units to shift to higher-value-added production. Consequently, Singapore's exports of electronic components have risen dramatically in recent years, despite consolidation of its global market share for electronics. Key examples of high-value intermediate electronics include integrated circuits, transistors, digital central processing units, optical disk drives and transmitter receivers. This surge in exports of highly specialized electronic components accounts for the growing importance of the regional market as an export destination for several Asian countries.

15. In the case of China, a relatively late arrival in this sector, a combination of abundant labour and R&D capabilities has enabled the country to become a manufacturing base for a wide range of electronic products and components of varying technological intensity. China's attractiveness results from a combination of factors, including a large domestic market for IT products and services; the availability of low-cost IT skills and fast-improving infrastructure; large-scale capital flows into China; and supportive government policies.

### **Latin American and Caribbean countries**

16. The region is currently the second most important developing-country region (after Asia) in terms of total value of electronic goods. In cross-country comparisons, Latin America and the Caribbean region stand out as very heterogeneous in terms of export performance in the electronics sector. On the one hand, for example, Mexico exported telecommunication equipment worth \$11 billion in 2004 (one sixth of the total regional exports for one product in one country). On the other hand, a number of countries, especially in Central America, have modest values for trade in electronics.

17. Overall, Brazil is the second leading exporter in the region, with exports of its top product (telecommunication equipment) amounting to around \$1.4 billion – about one eighth of Mexico's exports of the same product group. Thus Brazil cannot be said to have a substantial impact on the sector.

18. Even with export growth rates fluctuating significantly for specific countries and products, the overall trend until 1995 was decline. Thereafter, a positive trend emerged, which was rather fragile because it was based on a smaller number of products and countries. This trend ended abruptly in 2004 with the global downturn in electronics, and the performance of countries that had seen export growth rates increase throughout the late 1990s (e.g. Belize, Bolivia, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Suriname, Trinidad and Tobago and Uruguay) began to level off. It is possible that any consolidation in the sector was away from these countries and into others, often outside the region, which would point to the weakness of the region's electronics sector.

19. The difference between Mexico's performance and that of other countries in the region can be explained in part by Mexico's stronger ties with North America. This indicates that the region has not yet developed an autonomous dynamism within the electronic sector. Both Mexico and the



Dominican Republic have taken advantage of their proximity to the United States. So far, in Mexico, the electronics sector has not consolidated enough to develop further outsourcing southward in the rest of Latin America. Nonetheless, Mexico and the Dominican Republic have developed strong supply capacity and cost competitiveness.

20. The region's potential for further consolidation remains very high. Countries with large internal markets, such as Brazil and Argentina, need not rely heavily on outsourcing to boost growth but should also actively tap domestic purchasing power by improving competitive supply capacity and upgrading existing technology if they want to play a major role in the global electronics sector. Trade integration among countries of the region can (especially for smaller countries) increase their potential for greater participation in the sector once an already large market and significant supply capacities are pooled.

### **North African and Middle Eastern countries**

21. The export performance of the region in electronic products is marked by an accentuated upward trend that started around 1993 and brought exports to \$7.1 billion in 2003. Until 2000, the average export growth rate was around 20 per cent. Thereafter it fell as the region recovered more slowly than the Asia-Pacific region from the 2001 technology bubble.

22. Cross-country data indicate that, starting in 1998, certain countries in the region began to stand out in terms of export values. In particular, in 2004 Morocco, Tunisia and Turkey emerged as regional leaders for, respectively, electric components, televisions and other domestic equipment, and electric circuits and distribution equipment. However, the overall export values for electronics, which stayed between \$4.4 billion and \$7.1 billion in the period 2000–2003, are not comparable to those of the world leaders in the sector, although they represent a significant contribution to national economies in terms of diversification and growth opportunities.

23. Regional patterns have begun to emerge in North Africa and the Middle East, with Morocco, Tunisia and Turkey appearing to be imitated by Algeria, Jordan and possibly Lebanon and Syria. In addition, some countries have been able to take advantage of their geographical location. Both Morocco and Turkey enjoy strong regional ties with Europe and have a sizeable labour force that can produce labour-intensive products or components at a competitive cost. It remains to be seen whether these countries will be able to climb the ladder of value-added electronic products, establish their position in the current product groups, and compete successfully with those that are well established both within and outside the region.

### **Sub-Saharan African countries**

24. The region's overall performance in electronics has been characterized by modest export values and wide fluctuations in growth rates. Export values for the region as a whole showed accelerating growth starting in 1998, with overall values doubling in just two years. After the 2004 recession in the sector, export values fell back to pre-1998 levels. The overall lacklustre manufacturing and export performance in this sector reflects low and uneven growth in manufacturing value added for the region relative to other developing regions, as well as the region's reliance on low-technology manufactures.

25. At the country level, the dynamics in the value of trade for the sub-Saharan region are dominated by South Africa, which accounts for nearly 80 per cent of the region's overall exports

of electronic products. While South African exports of telecommunications products increased substantially around the turn of the century, the situation since 2001 has been difficult. If South Africa is excluded, the region has a very low export value base that has remained relatively unchanged over the last 15 years.

26. The export performance of sub-Saharan African countries in terms of export value suggests that as world trade in electronics slowed considerably in 2004, the latest and weakest entrants risked being forced to exit altogether. This is especially true of countries that cannot rely on a domestic market to absorb spare supply when foreign demand slows. However, at least two countries, Mauritius and Nigeria, were able to buck the trend. For example, electronics exports from Mauritius grew steadily from an insignificant initial export base in the mid-1990s to \$50 million in 2004.

27. Export growth figures in the electronics sector for the region are unevenly distributed and volatile. The overall trend is negative, meaning that export growth rates have been consolidating towards more modest values. This could mean one of two things. It could be a positive sign: as the industry consolidates in a particular country, market shares increase and growth rates will tend towards a lower long-run sustainable level. It could also be a negative sign, with the industry witnessing little evolution and consolidation and passively following the short-term ups and downs of the world market. Unfortunately, overall the second scenario seems more accurate. There are two indications of this: the low and constant base in trade value, and the evolution of growth rates, which strongly mimics trends in world trade.

### **III. Policy challenges for developing countries**

28. The emergence of developing countries as increasingly important players in world trade in electronics is in large part an Asian success story. While some countries in other developing regions have performed notably, it is the East and Southeast Asian countries that have been able to claim an ever-growing share in global electronics manufacturing and trade. For some of these countries, electronics exports are the highlight of their export economy. What are the prospects for other developing countries to follow in their footsteps?

29. It appears that late or new entrants, especially those with small economies (e.g. most LDCs), will find it much more difficult to establish a significant export presence relative to the successful early arrivals. Rapid changes in technology, organization of production and information exchange, and management practices in electronics manufacturing and trade in response to fast-changing customer demand and preferences, changes in income, product innovation and differentiation, and intense price competition make it extremely challenging for even the existing players to keep their market share.

30. Labour-intensive assembly-type operations have acquired the characteristics of commodity production, with prices falling over time.<sup>6</sup> This not only makes it hard to stay competitive but also reduces the value added. In certain cases, such as offshore chip assembly, which now requires capital-intensive and sophisticated production processes, technological changes can make earlier labour-intensive activities redundant. Yet labour-intensive manufacturing and assembly remain

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<sup>6</sup> For example, the prices of computers (SITC 752), transistors (SITC 776), telecommunications equipment and parts (SITC 764) and computer and office machine parts (SITC 759) have been falling worldwide since the early 1990s. See UNCTAD (2005), *Trade and Development Review 2005*.

the most feasible entry point for newcomers. Furthermore, for developing countries already established in this sector, a labour-intensive strategy is becoming an increasingly unattractive option. Their steady movement away from such production, and the inexorable pressure on global production networks to constantly look for cheaper sources of supply, will keep the gate open to new entrants.

31. However, there is no single set of factors affecting ability to enter and/or expand participation in the electronics sector, nor would it be suitable for all countries to attempt to do so. These factors vary across sectors and among countries. A major lesson from successful experiences is that a country needs to make the necessary strategic policy choices based on a realistic assessment of actual and potential comparative advantages with regard to different sub-sectors as well as in the context of the entire value chain. Much also depends on effectiveness in identifying and securing opportunities within particular product groups and production networks. Nevertheless, judging from the experience of successful developing countries, the following factors are worth noting:

- robust and flexible supply capacity to respond to rapidly changing demand and preference conditions
- effectiveness of integration into international production networks
- adequate market access and market entry conditions
- regional cooperation

#### **Box 1. Building a globally competitive electronics industry: The case of Thailand**

Thailand has been remarkably successful in building a globally competitive electronics industry. It is estimated that \$4.5 billion was invested in the electronics industry between 1986 and 2001, and the sector has created about 300,000 jobs in Thailand. It accounts for nearly one third of Thailand's total exports and one sixth of its net FD inflows. The main export items include hard disk drives and parts and integrated circuits. Thailand has emerged as the second largest hard disk drive producer in the world after Singapore.

These achievements rely a great deal on supportive government policies. At the initial stage, FDI was promoted by the Board of Investment (BOI) through a variety of incentives such as applying low tariffs to electronics imports for producing and exporting purposes, eliminating foreign ownership controls, and providing essential infrastructure in combination with a low-cost skilled labour force. Promotion of FDI enabled Thailand to become an important export-oriented production location for TNCs.

Despite these successes, Thailand's electronics industry still mostly consisted of assembly operations. Therefore the Government shifted its strategy to upgrading production, including by focusing on building capacity for operating sophisticated assembly plants and generating novel processes and products. Initiatives such as the development of the Thailand IC Design Incubator and the hard disk drive development project indicate a commitment to move up the value chain.

*Source:* UNCTAD (2005). *A Case Study of the Electronics Industry in Thailand* (UNCTAD/ITE/IPC/2005/6).

## **Building competitive supply capacity**

### ***Responding to changing income, demand and preferences***

32. Innovation and product development in response to changing consumer income, demand and preferences are an important aspect of the electronics sector that sets it apart from certain other globalized sectors such as textiles and clothing. Unlike electronics, textiles have little embedded technology, and this makes their longer-term development much more limited than that of products whose major component is at an ever higher technological level. Electronic products generally enjoy higher income elasticity of demand. For example, demand for information technology products in many countries has outpaced income growth, resulting in an increase in the share of spending thereon. The electronics sector has the potential to expand continuously if technology keeps advancing. A virtuous cycle can be generated, as the sector generally displays increasing returns on R&D and innovation.

33. In this context, the development of dynamic firms is an obvious policy priority, since a dynamic sector depends on the dynamism of its firms, which in turn results from the ability to absorb technology, spread it to others and develop it further.<sup>7</sup> Development strategies need to aim at (a) strengthening the ability of firms and their networks to innovate and integrate technology towards specialization in higher-value-added products; (b) facilitating greater access to specialized information, including market intelligence and international knowledge sourcing, greater supplier-producer interaction, provision of high-quality public goods, support to build brand recognition, and other business and trade facilitation measures to improve collective efficiency and competitiveness; (c) developing reliable and high-quality infrastructures, such as well-maintained transport and communication infrastructure; and (d) providing financial, information, communication, marketing and logistical facilities. For both newcomers and developing countries with established export presence in this sector, supportive government policies are essential for overcoming the increasingly complex constraints and challenges involved in building and improving an export presence.

34. Perhaps the biggest impact on the electronics sector from policy decisions comes from the development of human capital. Policy makers can increase levels of human capital via a number of strategies. In any case, what needs to be emphasized is the ability of human capital to bring new ideas rather than react to old ones; in other words, it is the creative component behind the skills that should be enhanced. Cooperation between educating institutions and the business sector is thus vital, as one benefits from the advancement of the other, especially in a dynamic sector. For example, new ideas could be tested for commercial viability, and students would get a taste of the risks as well as opportunities within the industry. Incubators of start-ups are also a widely used tool within the sector, and they could receive long-term financial support from local and domestic institutions. Countries that do not have access to advanced financial tools and products should consider the provision of stable access to financing as an investment in the future. Clustering and Internet use are some approaches to making institutional incubators manageable even on a cost basis for local and national governments.

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<sup>7</sup> UNIDO (2003) "Malaysian Electronics: at the crossroads" *SME Technical Working Paper Series No.12*

### *Effective integration into international production networks*

35. The performance of more successful developing countries in expanding exports of electronic products and components is intimately linked with the expansion of international production systems. Rapidly changing corporate strategies and increasingly complex production systems make it difficult for smaller and newer developing-country suppliers, who lack the necessary capabilities and competitive advantage, to participate in global production systems. Nevertheless, it should be a key priority for developing countries to identify and continuously expand their niches along the entire value chain. Export performance requirements linked to incentives such as export subsidies have been used by a number of countries to encourage TNCs to take advantage of export opportunities, but such subsidies are restricted under the Agreement on Trade-Related Investment Measures. Developing countries also need to persuade host country affiliates to create deeper domestic linkages, as well as to diffuse skills, knowledge and technology to domestic firms and to upgrade human, managerial and institutional resources.

### *Avoiding the low- and declining-value-added trap*

36. The benefit derived from exports is determined largely by the amount of domestic value added. Some East and Southeast Asian countries that started out with labour-intensive manufacturing and assembly have embarked on major upgrading exercises to improve their position in the value chain. Developing countries that using a strategy of labour-intensive manufacturing should be aware of the possibility of a low- and declining-value-added trap arising from (a) the “export illusion” caused by the high import content of exports (so that export earnings do not reflect the true domestic value added) and (b) the “fallacy of composition”, which arises when too many countries rush into the same sectors or products, thereby driving down terms of trade and export earnings and thus denying themselves the achievement of the original objective of improving domestic value added. Several highly populated developing countries, such as China and India, have been participating in labour-intensive segments of electronics, a fact that should be taken into account by others.

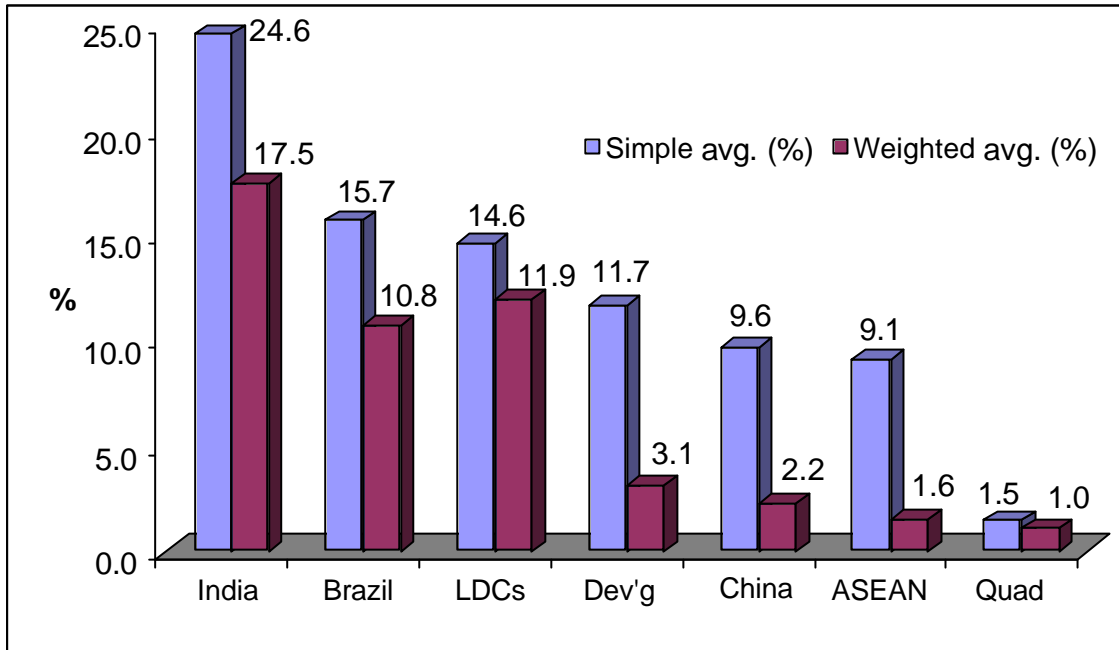
### *Market access and entry*

37. Developing countries' effective participation in world trade in electronics depends critically on their ability to respond to new opportunities arising in world markets. Their capacity to do so depends significantly on market access conditions and market entry requirements set in importing countries, including by large distribution networks.

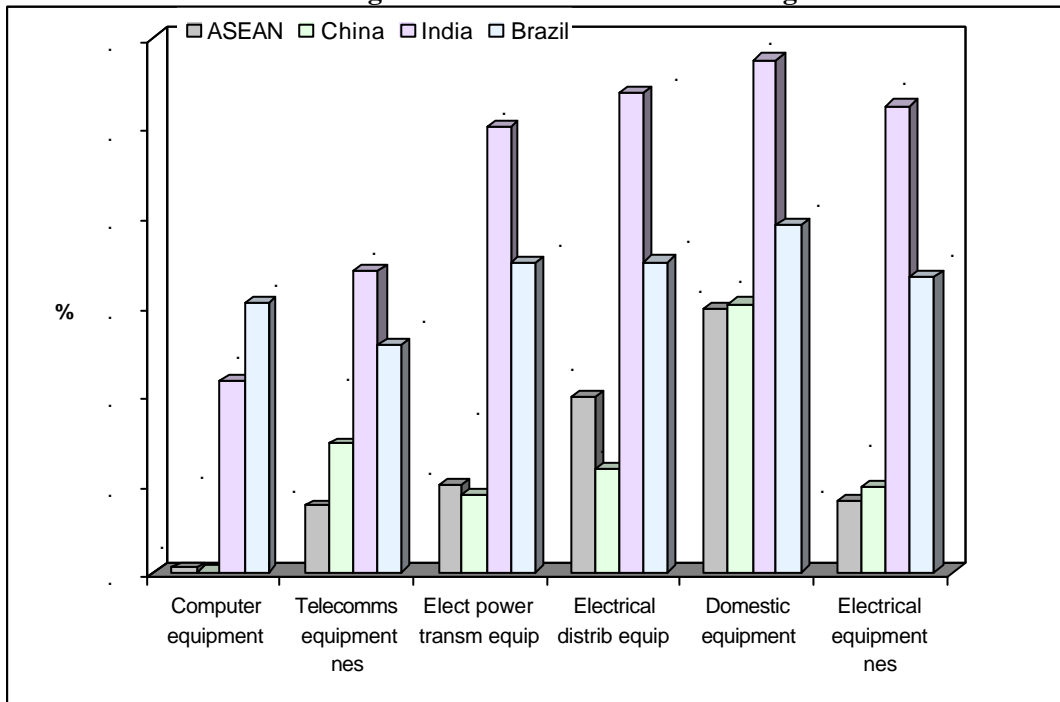
38. **Tariffs.** A quick look at the MFN tariff rates for different sectors show that the developing world has higher tariff rates than the Quad countries (the United States, Canada, the European Union and Japan). In particular, for the electronic and electrical goods sector, the overall MFN rate (simple average) in 2004 was 11.71 per cent for developing countries and 14.66 per cent for LDCs, whereas for the Quad countries it was 1.5 per cent. As figure 2 shows, LDCs as well as some developing countries such as India and Brazil have high average tariffs. The ASEAN countries' figures are much closer to the Quad countries when MFN tariff rates are computed in terms of weighted average. It should also be noted that the variability of MFN tariff rates is higher among developing countries than among Quad countries. This pattern can also be seen if one looks closely at the total number of lines and also the number of domestic and international peaks. Overall, it is not tariffs but non-tariff barriers (NTBs) that constitute the major market access barrier to developing-country exports of electronics to developed countries. At the same

time, there is significant scope for tariff liberalization among developing countries in this sector. The ongoing GSTP negotiations can play an important role in this regard.

**Figure 2. Average MFN tariff rates for electronic and electrical goods in 2004**



**Figure 3. Targeted approach to tariff liberalization:  
 MFN tariff rates weighted for electronic and electrical goods in 2004**



39. Tariff liberalization in certain countries can be viewed as part of a targeted approach to achieving a balance between protecting sub-sectors with a large domestic market, on the one hand, and promoting production for export, on the other. China and the ASEAN countries appear to have followed this approach, as is indicated by their differential tariff rates for different product groups (figure 3). Thus, China has reduced tariffs in sectors like computer, telecommunication and electrical equipment drastically over the years so as to boost productivity and efficiency in these sub-sectors, where there is steadily increasing foreign collaboration. But tariff rates for domestic equipment are still high, apparently to allow local firms to take advantage of domestic market conditions. Also, there is an overall convergence of China's tariff rates with those of the ASEAN countries, which should help them to take better advantage of regional division of labour in this sector. However, in the case of India, and to a lesser extent Brazil, such a targeted approach is less evident.

40. *Non-tariff barriers.* Electronics exports are subject to growing and increasingly strict standards and technical regulations, many arising from private and non-governmental origins, whose declared objectives are to protect human and animal life and health, plant health, the natural environment and wildlife; to ensure human safety and national security; and to promote corporate social responsibility and prevent deceptive practices (see box 2). As tariff barriers and quantitative restrictions are dismantled, there is concern that product- and process-related requirements, including environmental and health requirements, are being unwittingly or otherwise used as technical barriers to trade, thereby complicating market access and entry for developing countries.<sup>8</sup>

41. Not enough credible or consistent information is available on the types of problems arising from these requirements. However, an OECD study indicates that machinery and electronics are subject to the highest incidence of technical barriers to trade (TBTs). Such TBTs mostly relate to technical regulations and standards affecting in particular electrical apparatus and computers and parts thereof. These products also involve the largest number of complaints about import licensing procedures.

42. Rules of origin are considered a significant NTB in the electronics sector given the fact that they require complex definitions and methods. For example, Singapore applies a general value-added rule for the Agreement between New Zealand and Singapore on a Closer Economic Partnership, while it applies product-specific rules of origin for the United States–Singapore Free Trade Agreement. It is evident that lack of compatibility with regard to rules of origin is raising business costs. Compatibility improvements might be necessary in this regard.

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<sup>8</sup> For a detailed analysis of the implications of environmental and health requirements for developing countries' market access in the electronics sector, see Hoffmann, Ulrich, "Environmental/Health Requirements, Market Access and Export Competitiveness – What is the Problem for Developing Countries and What can be the Answers?" Paper presented at the Sub-Regional Workshop on Environmental Requirements, Market Access and Export Competitiveness of Electrical and Electronic Products from China, Philippines and Thailand, Manila, 18–20 February, 2004.

**Box 2. Environmental requirements in the electronics sector**

Concern over environmental and health-related problems associated with growing volumes of post-consumer waste from electrical and electronic equipment (EEE) has triggered significant environmental policy initiatives. This concern is reflected in comprehensive new legislation introduced in the European Union, Switzerland and Japan, with increased emphasis on the prevention, re-use, recycling and recovery of waste EEE through the application of the principle of producer responsibility. Legislation is also being introduced, at the sub-national level, in the United States (e.g. in the State of California) and Canada.

Globalized supply chain management plays a key role in adjustment to new environmental requirements. Small and medium-sized enterprises must conform to requirements set by global supply chains or risk being phased out as input providers. For the concerned exporting countries, it is more effective and cost-efficient to combine adjustment to external requirements for exported EEE with adjustment to domestic needs for sound national collection and management of EEE waste, which goes beyond recycling. To achieve this, these countries need not only accurate and timely information but also help in interpreting such information to make it relevant for adjustment strategies.

Key issues in this regard include awareness of new environmental requirements in different segments of the EEE sector in rapidly industrializing countries, cooperation in information sharing and consultations among developed and developing countries, and adjustment approaches in concerned developing countries. There should be greater efforts to identify possible market access implications for developing countries in the process of developing new environmental regulations as well as efforts towards increased dialogue with these countries. This should assist governments and companies in developing countries in making timely adjustments to external environmental requirements. The UNCTAD Consultative Task Force (CTF) on Environmental Requirements and Market Access and similar initiatives can play a useful role in this regard.

*Source:* UNCTAD.

43. Following are some key difficulties with regard to NTBs:

44. ***Transparency and market access issues in the context of WTO Agreements.*** There is a real risk that in implementing the WTO TBT Agreement, the environmental and health requirements can be turned into TBTs. How these can be identified as such, however, remains an open question.<sup>9</sup> There are several possible ways to address the issue, such as the following: (a) strengthening the role of science in the TBT Agreement (including, for example, replacing the current legitimacy test with a necessity test and linking it to a risk assessment); (b) effective implementation of the transparency requirements in the TBT Agreement, such as early notification of such requirements to the WTO secretariat, effective participation of developing countries in pre-standard-setting consultations, and close monitoring of the implementation of environmental and health requirements; (c) reducing the impact of such measures on developing-country exports through effective use by these countries of the existing special and differential

<sup>9</sup> For example, the TBT, SPS and GATT Agreements do not contain specific benchmarks or criteria for the legitimacy of environmental requirements. Thus, a specific environmental requirement is considered appropriate pursuant to TBT Article 2.2 and GATT Article XX, unless a dispute settlement panel decides otherwise. There is, however, an important difference between the TBT and SPS Agreements, as Article 5.1 of the latter requires a prior risk assessment to provide evidence of the necessity of measures taken.



treatment provisions, such as Article 12 of the TBT Agreement; and (d) effective implementation of Article 11 of the TBT Agreement on technical assistance.

45. ***The supply-chain-driven nature of health and environmental requirements.*** The private sector is increasingly imposing voluntary standards, codes and benchmarks, often as part of corporate social responsibility. In practice, supply-chain-driven requirements, which are often *de facto* mandatory, account for the majority of all environmental and health requirements in international markets. In other words, supply chains, rather than formal trade policy, are an increasingly important vehicle for spreading these requirements. Consequently not much can be done through the WTO to address concerns arising from them. As environmental and health requirements become an integral part of product quality in many markets, it is important for developing-country exporters to take this into account in order to appropriately position their brands and maintain international competitiveness.

46. ***Lack of international standards and technical equivalence on national standards.*** While the TBT Agreement emphasizes use of international standards where they exist,<sup>10</sup> in practice an international standard did not exist in many of the prominent cases where environmental requirements have created market access problems for developing-country exporters.<sup>11</sup> Even when such standards exist, these are often created by large developed-country companies, which raises the concern that the standards may reflect developing-country concerns. Where international standards do not exist, Article 2.7 of the TBT Agreement encourages Members to accept as equivalent technical regulations of other Members, even if these differ from their own. However, there has been little effort to multilaterally negotiate technical equivalence agreements, and little progress in doing so. Existing agreements are mostly bilateral. An enabling international framework could be a tool for facilitating technical equivalence agreements.

47. ***Capacity-building support.*** Many firms in developing countries, especially those that are relatively recent entrants into the world electronics market, find themselves constrained in terms of their ability to identify relevant requirements, undertake necessary technical, institutional and procedural adjustments, and demonstrate compliance. A range of technical assistance and capacity-building initiatives for developing countries are carried out by international, multilateral and regional organizations, as well as NGOs and through bilateral assistance, to facilitate compliance with technical standards and regulations in external markets. The vast majority of such activities appear to be implemented piecemeal, which indicates the need for a coherent and holistic approach. Also, there should be more proactive policies in developing countries themselves to analyse possible trade effects of such standards and requirements in key export markets, improve information management and increase awareness, and develop versatile adjustment approaches to improving export competitiveness.

### **South-South regional cooperation**

48. An important element that emerges from the geographical groups analysed above is the regional effect. Neighbouring countries often mirror, with a time lag, the performance of regional

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<sup>10</sup> Article 2.4 of the TBT Agreement provides that "where technical regulations are required and relevant international standards exist or their completion is imminent, Members shall use them, or the relevant parts of them, as a basis for their technical regulations...".

<sup>11</sup> OECD (2003). *Addressing Market Access Concerns of Developing Countries Arising from Environmental Requirements: Lessons from National Experiences* (COM/ENV/TD(2003)33).

leaders with successful policies and business environments. They often take advantage of outsourcing possibilities created by the leader country. Progression towards higher-value-added products leaves an opportunity for other countries to enter the sector by adopting the freed-up technology with lower returns. Other times, countries imitate best practices and apply them to products similar to their neighbours' but not directly competing with them. Both effects seem to be at work in the case of electronics, especially in Asia, where technology advances and creation of value added are faster than probably anywhere else in the world.

49. The ASEAN Free Trade Area (AFTA) provides an example of South-South cooperation in the electronics sector. The AFTA roadmap for integration of the electronics sector covers tariff elimination, non-tariff measures, rules of origin, customs procedures, standards and conformance, logistics services, outsourcing and industrial complementation, integration systems of preferences, investments, trade and investment promotion, intra-ASEAN trade and investment statistics, intellectual property rights, movement of natural persons, facilitation of travel in ASEAN, human resource development, customs procedures, mutual recognition arrangements and capacity building. A notable policy measure in this regard is that intra-regional tariffs were reduced to 0 to 5 per cent, which enabled division of the sophisticated production chains of TNCs inside the region.

50. South-South trade and regional economic and trade arrangements can thus provide a supportive environment for latecomers and newcomers to this sector. Indeed, in the case of East and Southeast Asia, electronics has been a key sector of South-South trade. Their experience indicates that the dynamically changing regional division of labour is a particularly relevant goal for regional cooperation in this sector. This can help developing countries, especially those with structural constraints and small economic size (such as LDCs and small island developing countries), to escape the low- and declining-value-added trap, take advantage of one another's growing markets in electronics, and avoid trade barriers, including a variety of regulations and standards, in developed-country markets.

## Annex

## Dynamic products in world exports, ranked by change in market share, 1985–2002

Rank	SITC 2 code	Product	Market share (%)			Value of world exports (current US\$ millions)		Developing-country share of world exports (%)		Average annual growth rate of world exports (%)
			1985	2002	Increment	1985	2002	1985	2002	1985-2002
1	7764	electronic microcircuits	0.67	2.93	2.26	10 213	163 336	15	15	18
2	5417	medicaments	0.60	2.22	1.61	9 101	123 459	5	4	17
3	7643	radiotelegraphic & radiotelephonic transmitters	0.16	1.36	1.21	2 365	75 859	1	22	23
4	7599	parts of and accessories of office machines	1.18	2.10	0.92	17 869	117 165	0	26	12
5	7524	digital central storage units	0.01	0.67	0.67	136	37 568	0	22	39
6	7924	aircraft	0.41	1.04	0.63	6 247	58 061	1	2	14
7	7810	automobiles	5.43	6.05	0.62	82 193	337 012	1	9	9
8	7649	parts of telecommunications apparatus	0.66	1.13	0.46	10 058	62 805	2	26	11
9	8939	miscellaneous art. of resins and plastic materials	0.43	0.82	0.39	6 474	45 731	2	20	12
10	7522	computers	0.28	0.61	0.33	4 275	34 123	0	33	13
11	7721	elect. appliances such as switches, relays, fuses, plugs, etc	0.75	1.08	0.33	11 331	60 045	4	20	10
12	8462	cotton under garments	0.11	0.41	0.30	1 689	23 015	19	57	17
13	5148	nitrogen-function compounds	0.15	0.44	0.29	2 261	24 603	4	6	15
14	7528	off-line computers	0.04	0.33	0.29	587	18 363	1	28	22
15	5839	polymerization and copolymerization products	0.17	0.46	0.29	2 611	25 698	2	7	14
16	5530	perfumery, cosmetics and toiletries	0.20	0.48	0.29	2 976	26 847	5	11	14
17	7788	elect. machinery and equipment	0.51	0.79	0.27	7 762	43 766	2	19	11
18	8211	chairs and other seats and parts	0.19	0.45	0.27	2 807	25 136	2	39	14
19	7132	int. combustion piston engines	0.34	0.60	0.26	5 154	33 447	9	22	12
20	7731	insulated, elect. wire, cable, bars, strip	0.31	0.57	0.26	4 732	31 762	3	46	12
21	8720	medical instruments and appliances	0.27	0.50	0.23	4 041	27 686	2	13	12
22	7712	electric power machinery	0.15	0.36	0.22	2 249	20 258	2	32	14
23	8743	non-electrical instruments for measuring, checking flow	0.08	0.30	0.21	1 268	16 554	1	17	16
24	5416	glycosides; glands or other organs & their extracts	0.07	0.28	0.21	1 105	15 842	2	4	17
25	8710	optical instruments & apparatus	0.11	0.31	0.21	1 632	17 488	0	12	15
26	5989	chemical products and preparations	0.48	0.69	0.20	7 307	38 264	3	7	10
27	6415	paper and paperboard	0.16	0.36	0.20	2 381	19 799	3	15	13
28	8931	packing materials	0.13	0.33	0.19	2 036	18 340	3	24	14
29	7763	transistors and semi-conductors	0.20	0.40	0.19	3 067	22 084	15	26	12
30	8219	furniture and parts	0.39	0.59	0.19	5 978	32 616	3	32	10
31	7523	centralised computers	0.33	0.52	0.19	5 046	29 170	2	22	11
32	6552	knitted/crocheted fabrics	0.05	0.24	0.19	820	13 376	8	22	18
33	6672	diamonds	0.61	0.79	0.18	9 168	43 962	13	24	10
34	7525	computer peripherals	0.66	0.84	0.18	9 965	46 728	2	36	10
35	7641	telephonic & telegraphic equipt	0.36	0.54	0.18	5 510	30 237	0	25	11
36	5156	nucleic acids	0.32	0.50	0.18	4 867	27 768	2	8	11
37	7611	colour televisions	0.36	0.53	0.17	5 502	29 732	2	52	10
38	8439	outer garments	0.29	0.46	0.17	4 439	25 784	13	54	11
39	8983	gramophone records and similar sound recordings	0.35	0.52	0.17	5 286	28 724	2	8	10
40	7144	reaction engines	0.12	0.28	0.16	1 815	15 464	0	5	13
<b>All 40 products</b>			<b>18</b>	<b>34</b>	<b>16</b>	<b>274 325</b>	<b>1 887 673</b>	<b>3</b>	<b>19</b>	<b>14</b>

Source: United Nations COMTRADE database.